



Comparative Evaluation of Serum Ceruloplasmin Levels in Chronic Periodontitis Patients with and Without Diabetes Before and After Non-Surgical Periodontal Therapy

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Abstract

Introduction: Periodontitis is a common local inflammatory disease of tooth supporting tissues initiated by microorganisms present in dental plaque. Ceruloplasmin is 122 K-D multi copper binding plasma protein helps in transferring of copper that converts ferrous iron into ferric form. It is an acute phase reactant seems to increase in inflammatory conditions.

Aims and objectives: This study was taken up to compare and evaluate serum ceruloplasmin levels in chronic periodontitis patients with and without diabetes before and after non surgical periodontal therapy.

Materials and Methods: Group A: Ten patients diagnosed with chronic periodontitis without diabetes. Received scaling and root planning with mean pocket depth of 6mm, 5ml blood was drawn at baseline and 3 months after scaling and root planning

Group B: Ten patients diagnosed with chronic periodontitis with diabetes. Received scaling and root planning with mean pocket depth of 6mm, 5ml blood was

drawn at baseline and 3 months after scaling and root planning.

Results: Study was statistically significant in chronic periodontitis patients with diabetes than with the patients without diabetes. p value is <0.001 it is significant.

Conclusion: Successful non-surgical periodontal therapy improves serum ceruloplasmin levels concentration in non diabetic patients when compared with diabetic patients

Key words: Serum ceruloplasmin , Chronic periodontitis, diabetes mellitus, anti-inflammatory.

Introduction

Periodontitis is a common local inflammatory disease of tooth supporting tissues initiated by microorganisms present in dental plaque. As the disease progresses, there is periodontal pocket formation with increased attachment loss, alveolar bone destruction, and increased tooth mobility that ultimately result in the loss of the teeth.¹Diabetes Mellitus (DM) is a commonly prevalent systemic disease and has been proved to have a bidirectional relationship with periodontitis which is

characterized by hyperglycemia (elevated blood glucose) that results from defects in the secretion of the hormone insulin.²

Ceruloplasmin is a ferroxidase enzyme that in humans is encoded by the *CP* gene.³ It is a copper-containing plasma ferroxidase that plays an essential role in mammalian iron homeostasis. This protein is a member of the multi copper oxidase family of enzymes, utilizing the electron chemistry of bound copper ion to couple iron oxidation with the four-electron reduction of dioxygen.⁴ The protein is an alpha 2 glycoprotein which is synthesized in hepatocytes and is secreted into the plasma with six atoms of tightly bound copper/molecule.⁵ It has been proposed that the enzymatic oxidation of ferrous iron is an essential step in the formation of transferrin.⁶

Ceruloplasmin helps in transferring of copper within our body and also influences the uptake of iron into the cells because of its property of conversion of ferrous form of iron to the ferric form, due to which alterations in serum iron are often accompanied by changes in serum ceruloplasmin. It thus leads to a state of hyperemia. Ceruloplasmin is also an acute phase reactant seen to increase in inflammatory conditions.⁷ During the acute phase response of inflammation, ceruloplasmin synthesis and its concentration in the blood increases.⁸ This study was taken up to compare and evaluate serum ceruloplasmin levels in chronic periodontitis patients with and without diabetes before and after non-surgical periodontal therapy.

Materials and Methods

Twenty subjects of aged between 35- 60 years were selected from the outpatient sector of Department of Periodontics, St Joseph Dental College, Eluru during the period of Aug 2017 to Dec 2017. All 20 subjects fulfilled the inclusion criteria for the study, which includes the age limit and other systemically healthy patients except

diabetes who were eligible to participate in the trial. The patients were assigned into two groups of 10 each Group A [Non-Diabetic with chronic periodontitis], Group B [Diabetic with Chronic Periodontitis], The patients with a history of periodontal treatment within the Past 6 months, under any medication, patients who have smoking habit, pregnant and lactating women and with history of any viral infection in past 6 months were excluded from the study. Subjects fulfilling the selection criteria were chosen successively and ethical clearance was obtained from the institutional review board. Admissible information regarding the study protocol was illuminated to each patient, and written informed consent was obtained from all participants. The routine biochemical investigations like Hb%, CT, BT, TC, HbSAg, tridot and a confirmatory test for diabetes was done using spectrophotometric method (glucose oxidase-peroxidase, Bosnalijek). After the confirmatory test of diabetes is recorded then the patient is divided according to classification given by American Diabetes Association.

Periodontal parameters: A complete periodontal examination, includes: gingival index (GI), plaque index (PI), bleeding on probing (BOP), probing depth (PD), clinical attachment loss (CAL) were recorded at baseline and 3 months after phase 1 therapy (scaling and root planning). Measurement of serum Ceruloplasmin levels: 5ml of blood was collected from the antecubital fossa by venipuncture using 20-gauge needle. The collected serum was evaluated for serum ceruloplasmin. All the patients including group A and group B underwent clinical examination, serum evaluation, periodontal therapy (scaling and root planning) and recalled after 3 months for clinical and serum evaluation.

Statistical Analysis

Statistical analysis was performed using SPSS ver21. Periodontal parameters and serum Ceruloplasmin levels

were compared between the groups using PAIRED T test of variance. $P < 0.05$ was considered statistically significant.

Results

This study was performed to assess and compare the levels of serum ceruloplasmin in the patients having chronic periodontitis which included both diabetic & non-diabetic subjects. The mean values of each of the clinical parameters were evaluated using independent sample t test.

The clinical parameters such as Probing Depth (PD), Clinical Attachment (CAL), Plaque Index (PI), Sulcular Bleeding Index (SBI) were also evaluated. PD and CAL reflects the health of periodontal tissues (indicates health/disease). PI indicates the oral hygiene status of an individual. SBI denotes the inflammatory status of periodontal tissues. The means of PI, GI, PD, CAL, CP in Group A at baseline and 3 months after srp showed a statistical significance. The mean and p values at baseline showed a significant reduction of means at 3 months after srp. The mean serum ceruloplasmin values of the study groups i.e. diabetic and non-diabetics before and after non-surgical periodontal therapy (NSPT) were 27.6 mg/dl, 22.4 mg/dl, 24.4 mg/dl & 19.6 mg/dl respectively (table-1 & graph-1). There is significant decrease in the ceruloplasmin levels after non-surgical periodontal therapy has been performed both in diabetic and non-diabetic groups. It was also reflected in the periodontal tissue parameters (table -2, table-3).

Table1: Comparison of mean, standard deviation and P values of Ceruloplasmin, PI, GI, PPD, CAL in group A (non diabetics). All the periodontal parameters along with ceruloplasmins have reduced to highly statistical significance from baseline to 3 months (p value 0.001 indicating 99% confidence).

Parameter		Mean	Std. Deviation	P value
Ceruloplasmin	Before NSP	22.4000	1.34990	0.001
	After 3 months	19.6000	1.26491	
PI	Before NSP	1.8000	.63246	0.001
	After 3 months	.9000	.31623	
GI	Before NSP	1.6000	.51640	0.001
	After 3 months	.5000	.52705	
PD	Before NSP	5.2000	1.13529	0.001
	After 3 months	2.5000	.70711	
CAL	Before NSP	5.6000	1.50555	0.001
	After 3 months	2.7000	.82327	

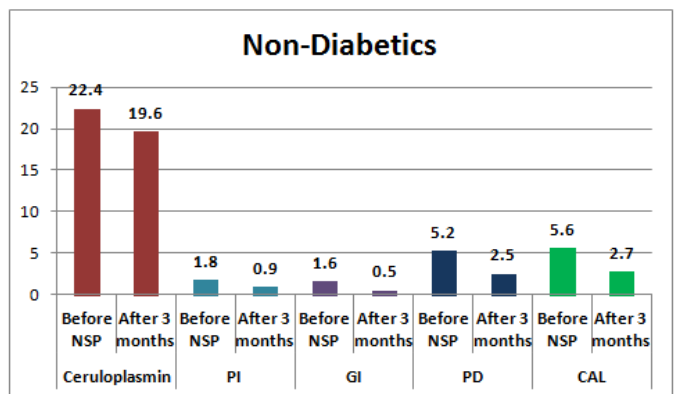


Table2: Comparison of mean, standard deviation and P values of Ceruloplasmin, PI, GI, PPD, CAL in group B (diabetics). All the periodontal parameters along with ceruloplasmins have reduced to highly statistical significance from baseline to 3 months (p value 0.001 indicating 99% confidence).

Parameter		Mean	Std. Deviation	P value
Ceruloplasmin	Before NSP	27.6000	1.26491	0.001
	After 3 months	24.4000	1.57762	
PI	Before NSP	2.3000	.67495	0.001
	After 3 months	.8000	.42164	
GI	Before NSP	2.6000	.51640	0.001
	After 3 months	1.7000	.48305	
PD	Before NSP	7.9000	1.28668	0.001
	After 3 months	4.3000	.94868	
CAL	Before NSP	10.2000	1.31656	0.001
	After 3 months	5.7000	1.25167	

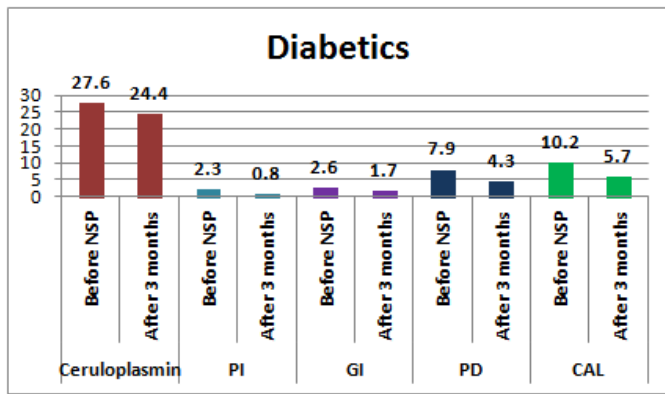
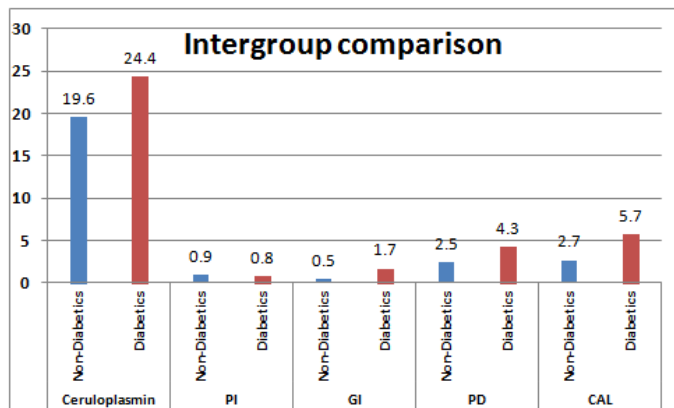


Table 3: Intergroup comparison of mean, standard deviation and P values of ceruloplasmin, PI, GI, PPD, CAL in group A (non diabetics) and group B (diabetics). All the periodontal parameters along with ceruloplasmins have reduced to highly statistical significance from baseline to 3 months (p value 0.001 indicating 99% confidence) both in diabetics and non diabetics but non diabetics have shown more significant improvement when compared to diabetics.

Parameter	Groups	Mean	Std. Deviation	P value
Ceruloplasmin	Non Diabetics	19.6000	1.26491	0.001
	Diabetics	24.4000	1.57762	
PI	Non Diabetics	.9000	.31623	0.556
	Diabetics	.8000	.42164	
GI	Non Diabetics	.5000	.52705	0.001
	Diabetics	1.7000	.48305	
PD	Non Diabetics	2.5000	.70711	0.001
	Diabetics	4.3000	.94868	
CAL	Non Diabetics	2.7000	.82327	0.001
	Diabetics	5.7000	1.25167	



Discussion

The aim of the current study evaluated the serum levels of ceruloplasmin in generalized chronic periodontitis with type 2 diabetes mellitus, and also to compare it with gingivitis and chronic periodontitis patients unmodified by diabetes mellitus. Pro inflammatory and anti-inflammatory markers usually keep dynamically changed during periodontal tissue destruction and disease process.⁹ Ceruloplasmin (Cp) is a copper protein which functions for maintaining iron homeostasis and inflammation¹⁰ Superoxide anion radicals have been mentioned as mediators of inflammation and tissue injury. Harm to periodontal tissues from superoxide anion radicals is provided by superoxide dismutase (SOD) that catalyses the dismutation of superoxide to hydrogen peroxide and oxygen.¹¹ It can be thought that under conditions where levels of ceruloplasmin are remarkably increased in association with inflammatory diseases (such as rheumatoid arthritis), this acute-phase reactant may play a major role as a circulating scavenger of oxygen-derived free radicals.¹² Ceruloplasmin also acts as a negative target for hypoxia inducible factor (HIF-1α) which is created in an area of local inflammation during the infections.¹³ It is also seen to play a central role in excessive superoxide generation in phenotypically hyperactive and primed peripheral blood polymorphonuclear neutrophils (PMNs). Thus, the functions of ceruloplasmin are slightly varied. Ceruloplasmin functions as an anti-inflammatory agent and it can also work as a pro inflammatory molecule. Harshavardhana et al (2013) compared the serum levels of ceruloplasmin in patients with generalized aggressive & generalized chronic periodontitis. Their study postulated that even the periodontal pathogenic bacteria of chronic periodontitis can also lead to an increase in the activity of ceruloplasmin in absence of any other disease leading to

systemic infection. They also observed that as the CAL increased corresponding to the percentage of bleeding sites, the serum level of ceruloplasmin showed higher values. Even though the results were clinically significant, they were not statistically significant. Although the mechanisms whereby diabetes mellitus increases the severity of periodontal disease are not fully understood, one may propose that increased susceptibility to periodontal infection, impaired host response, and excessive collagen lytic activity all play a major role.¹⁴Literature review states that as the degree of periodontal inflammation increases, the level of anti-inflammatory mediators also increases in an attempt to check the increased inflammatory mediators. Studies have shown that expression of inflammatory cytokines like PGE₂, TNF- α , IL-6 is altered in both the disease conditions such as chronic periodontitis and diabetes mellitus. This could probably explain the increased levels of serum ceruloplasmin in periodontitis patients with diabetes mellitus

Conclusion

Within limitations of the study, an increased levels of ceruloplasmin before SRP showed a significant reduction levels after srp. This may predict the future risk of systemic diseases in chronic periodontitis patients with diabetes and without diabetes. Further studies with large samples are needed regarding ceruloplasmin for the better results.

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